



# 3D Printed Stretchable Tactile Sensors with Electronic Ink

**IP Status:** US Patent Issued;11,320,323

## Electronic Ink with Tunable Printability and Electrical Conductivity

A flexible tactile sensor, 3D printed with electronic inks, can detect and differentiate human movements (e.g., radial pulse and finger pressing/bending). The stretchable sensor consists of a conductive coil placed between two stretchable electrode layers. A custom, multi-functional 3D printing process prints silver-impregnated silicone inks with tunable printability and electrical conductivity to fabricate and cure the sensor under ambient conditions. The degree of silver loading in the silicone inks is controllable and can be used to vary sensor behavior.

## 3D Printable Tactile Sensor

Common methods to measure tactile stimuli include capacitive and piezoresistive mechanisms. Capacitive sensors exhibit excellent sensitivity, linearity, and temperature invariance, but electromagnetic interference can affect their performance. New methods to fabricate piezoresistive sensors into artificial skins directly onto conformal, geometrically complex structures could expand their impact. This new method fabricates stretchable tactile sensors 3D printed via a combination of nanocomposite ink optimization, 3D scanning, and multi-material 3D printing. The sensors show high performance/sensitivity useful for any application requiring pressure/tactile sensors and arrays.

### BENEFITS AND FEATURES:

- Detects and differentiates human movements (e.g., radial pulse and finger pressing/bending)
- Fabrication under mild/ambient conditions
- Simple, custom 3D printing process
- Can be applied directly to skin or sensitive components
- Flexible, stretchable, sensitive
- Adjustable stretchability and electrical conductivity
- Structural integrity withstands drying without delamination or distortion
- Printed on flexible substrate
- Printing onto arbitrary surfaces
- Printable into large-scale arrays
- Multi-functional, multi-material 3D printing (scan and print) process
- Tunable printability
- Range of electrical conductivity and piezoresistive response
- 3D printed using commercially available silicone, silver particles and additives
- Cured elastomeric inks mimic high flexibility and stretchability of human skin
- Compatible with biological substrates or materials (e.g., strain sensors capable of detecting human movement)

### APPLICATIONS:

## Technology ID

20170298

## Category

Engineering & Physical Sciences/Instrumentation, Sensors & Controls  
Engineering & Physical Sciences/Materials  
Engineering & Physical Sciences/Nanotechnology  
Engineering & Physical Sciences/Robotics  
Life Sciences/Human Health  
Life Sciences/Medical Devices  
Software & IT/Communications & Networking

## Learn more



- Wearable/flexible electronics for monitoring heart rate and/or blood pressure
- Tactile sensors
- 3D printing, integration with other 3D printable devices
- Wearable electronics and devices
- Prosthetics, prosthetic bionic skins, robotics, prosthetic skins
- Providing surgical tools with the sense of touch
- Haptic feedback
- Applications using durable, flexible, elastic sensors
- Energy harvesting devices
- Soft robotics
- Soft mechanics
- Biomechanical energy harvesting
- Biotic-abiotic interfaces
- Haptic feedback
- Providing surgical tools touch feedback

## Phase of Development

### Sensors

Prototype: device has been fabricated and characterized.

### Inks

Working prototype: ink formulated and used to make device (sensor).

## Researchers

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## Publications

[\*3D Printed Stretchable Tactile Sensors\*](#)

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